Board 224: Brownian Motion or Intentional Engagement? Addressing Practical Obstacles Between Two- and Four-Year STEM Transfer Institutions

Dr. Michelle Maher, University of Missouri, Kansas City

Dr. Michelle Maher explores STEM transfer student partnerships between two- and four-year institutions and higher education access and equity issues.

Dr. Darran Cairns, West Virginia University

Darran is an Adjunct Associate Professor in Mechanical and Aerospace Engineering at West Virginia University.

Prof. Reagan Curtis, West Virginia University

Reagan Curtis, Ph.D., is Derrick Endowed Professor of Educational Psychology and founding director of the Program Evaluation and Research Center at West Virginia University.

Dr. John Kevern, University of Missouri, Kansas City
Dr. Jacob M. Marszalek Ph.D., University of Missouri, Kansas City

Education: Dr. Marszalek received his Ph.D. in Educational Psychology, Statistics and Measurement at the University of Illinois at Urbana-Champaign in 2006.

Teaching: Dr. Marszalek teaches undergraduate quantitative statistics and graduate courses in S

Miss Kathleen O'Shea
Mrs. Carol Nicole Pflum, Longview Community College
ANTHONY WEISS

Anthony Weiss is a Ph.D. candidate in Mechanical Engineering with a co-discipline in Education, Leadership, Policy, and Foundations at UMKC. Prior to this he received his BS in Mechanical Engineering Technology from Pittsburg State University in 2016 where he also was a student-athlete participating in Cross Country and Track and Field. He went on to get his BS in Mechanical Engineering in 2019 from UMKC and then completed his Masters in Mechanical Engineering in 2020. He also worked for an engineering design firm in Kansas City for 6 years as a data scientist and design engineer and is a licensed P.E. in the state of Missouri.

Brownian Motion or Intentional Engagement?
Uncovering Obstacles in an Engineering Transfer Partnership

Introduction

"*We assumed a lot about our engineering transfer partnership when we began our S-STEM project. We now know our preconceived notions only lightly orbit the current reality*." This saying has become symbol of our NSF DUE (Division of Undergraduate Education)-funded S-STEM project, the Kansas City Urban Renewal Engineering (KCURE) scholarship program. Now in its third operational year, the KCURE program supports the transfer of low-income civil and mechanical engineering students. When our research team applied for S-STEM funding, we assumed we had a solid engineering transfer student partnership between Metropolitan Community College (MCC) and University of Missouri-Kansas City (UMKC).

However, the MCC engineering coordinator's retirement three years into KCURE program operations challenged this assumption and forced us to recognize obstacles constraining the MCC-UMKC transfer partnership. To gain systematic insight into these obstacles, the KCURE program's external evaluator interviewed MCC and UMKC project stakeholders. The purpose of this poster paper is to identify the obstacles that have shaped, at times tacitly, our MCC-UMKC engineering transfer partnership. In doing so, we hope to encourage other two- and four-year engineering education transfer partners to pause, name, and creatively seeks ways to address obstacles to their engineering transfer pathways.

Contextual Background

Initiated in 2020, our S-STEM program links two Midwestern area higher education institutions: MCC and UMKC. Program objectives are to: (1) increase the number of low-income, meritorious MCC transfer students who transfer to and graduate from the UMKC Civil and Mechanical Engineering (CME) degree program, and (2) instill within the UMKC CME department a culture that facilitates the full participation of low-income, meritorious MCC transfer students. The program is slated to provide 176 annual scholarships between 2020 and 2025 to an estimated 56 students; students are selected based on financial need and academic merit. Each scholarship includes a tuition award of $1,000 for the first year while at MCC, $1,250 for each additional year at MCC, and $7,000 each year while at UMKC. As of January 2023, the program has provided 57 scholarships. Four MCC transfer students supported by our S-STEM have earned their UMKC bachelor's degree in civil or mechanical engineering.

By concrete measures, our achieved S-STEM program outcomes to date have not matched expected outcomes detailed in our NSF grant proposal. In earlier work (Maher et al., 2022), we acknowledged the impact of the COVID-19 pandemic on our S-STEM project. A further complication is that the pandemic spurred an internal UMKC restructuring in which the civil and mechanical engineering programs were reassigned to different departments. Finally, project personnel have changed over time.

We believe the above factors have significantly impacted our S-STEM project. However, we also believe they do not fully explain our team's combined sense that our MCC-UMKC civil and

mechanical engineering transfer partnership is best described as an example of Brownian Motion. Mitchell and Kogure (2006) describe Brownian Motion as the random, uncontrolled movement of particles in a fluid as they constantly collide with other molecules. As applied to our S-STEM project, we have realized that the UMKC civil and mechanical undergraduate engineering programs passively recruit and enroll whichever MCC students randomly collide with the UMKC engineering application and meet UMKC admission criteria.

This type of arrangement is curious considering the following realities. First, MCC, which is in the same urban core as UMKC, enrolls many engineering students who intend to transfer to a four-year institution to earn a bachelor's degree. Second, almost half of UMKC civil and mechanical undergraduate engineering students are transfer students (UMKC Office of Institutional Research, n.d.). Finally, many two- and four-year institutions have seen declining enrollment in recent years (Marcus, 2022), including MCC and UMKC. Thus, strengthening the MCC-UMKC engineering transfer pathway would benefit not only (and most importantly) students, but also both institutions.

Conceptual Framing

Eddy and Amey (2014) distinguish between educational partnerships that are traditional or strategic. Traditional partnerships have a limited life cycle and often initiate from "legislative action, grant funding, or necessity" (Eddy & Schneider, 2019, p. 70). Strategic partnerships are generative; they match strategic objectives of both partners to intentionally build capacity between and for both partners. Building strategic partnerships takes time and effort. Eddy and Amey (2014) outline a three-phase model of strategic partnership development. The first phase considers the antecedents and motivations for a strategic partnership. As applied to KCURE, this includes factors such as geographical proximity and a shared need to attract, retain, transfer (or receive transfers), and graduate engineering students. The second phase speaks directly to the partnership development, which is facilitated by building relationships that are imbued with trust. The final phase is the achievement of partnership capital. As Eddy (2010) states:

> Partnership capital evolves over time as group members develop trust of one another; build shared meaning and understanding about ideas, goals, and outcomes associated with the partnership; and solidify the network of those involved in such a manner that the partnership can outlive those immediately involved. (p. 11)

The current MCC-UMKC engineering transfer pathway is a traditional partnership. However, it has become clear to us that the S-STEM KCURE project provides a unique opportunity for both institutions to move toward a strategic partnership.

Methods

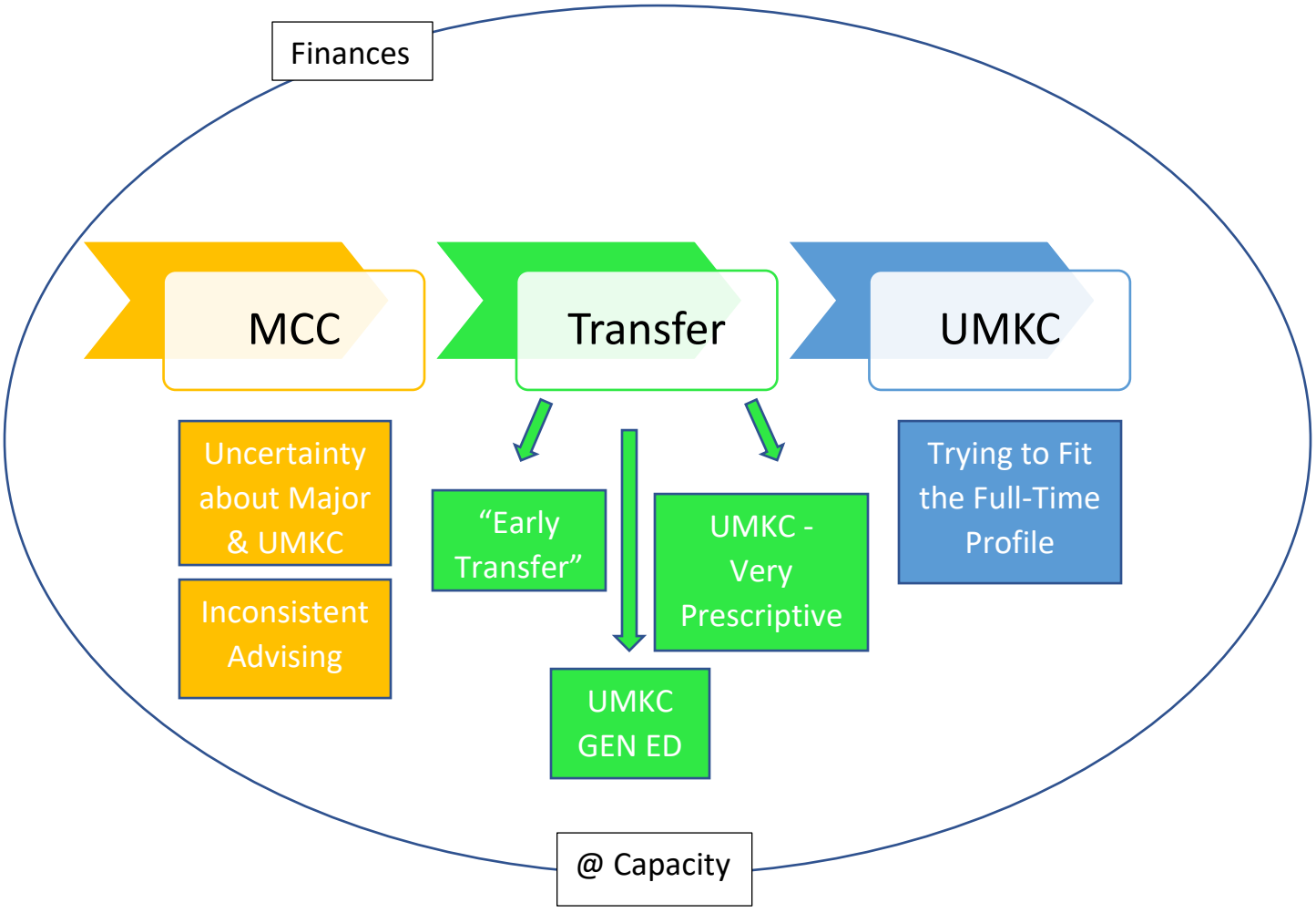
The current study is part of a larger KCURE programmatic review designed to document KCURE stakeholders' programmatic engagement and capture their perceptions of MCC-UMKC transfer pathway obstacles and KCURE program successes. In spring of 2023, the KCURE project external evaluator developed an interview protocol (see Appendix A) and invited a total of 15 KCURE stakeholders to participate in a semi-structured interviews via video conferencing.

Invited stakeholders included MCC and UMKC KCURE project personnel as well as MCC and UMKC academic advisors who had guided KCURE scholar recipients. Eleven (73%; 3 of 5 from MCC, 8 of 10 from UMKC) KCURE stakeholders agreed to be interviewed. Interviews were audio recorded and professionally transcribed. After de-identification, transcripts were shared with a small group of KCURE project personnel. They used conventional content analysis (Hsieh & Shannon, 2005) to analyze data associated with transfer obstacles.

Study Results and Discussion

As we noted earlier, the purpose of this poster paper is to identify the obstacles that have shaped, at times tacitly, our MCC-UMKC engineering transfer partnership. As Black and Gregersen (2002) noted, the first step toward implementing organizational change is to be able to *see* a need for change. When we initiated our KCURE program in 2020, we didn't *see* a need for change. This study provided us time to pause and reflect on what we did not earlier see. In Figure 1, we detail the MCC-UMKC engineering transfer pathway obstacles that indicate the need for change.

Figure 1: MCC-UMKC Engineering Transfer Pathway Obstacles



Our analysis uncovered eight obstacles in total. Two, *Finances* and *At Capacity*, impacted the MCC-UMKC engineering transfer partnership but largely fell outside of it. Specifically, an obstacle for almost all community college transfer students was finances. The KCURE scholarship money at least partly addressed this obstacle for those who received it, although it still loomed large in the background when thinking about engineering transfer students who did not. *At Capacity* referred to a common theme of both MCC and UMKC stakeholders reported feeling that the societal and institutional upheaval of the previous years had left them feeling, frankly, at capacity and perhaps a little burned out.

In the below findings, we focused on six obstacles within the MCC-UMKC engineering transfer partnership. These include two (*Uncertainty about Engineering Major and/or UMKC, Inconsistent Advising*) situated at MCC, three (*Early Transfer, UMKC Gen Ed*, and *UMKC Very Prescriptive*) situated within the transfer transition, and one **(***Trying to Fit the Full-time Profile)* situated at UMKC.

MCC Obstacles

Uncertainty about Engineering Major and/or UMKC referred to the reality that MCC students were often unsure of which major to select. Even if they selected engineering as a major, they sometimes struggled to select an engineering specialty. As study participants described:

> [A barrier is] the length of time that people can be spinning in the washing machine without deciding exactly what they want to do, without completing all the prerequisite coursework to get into a particular major … If you do a transfer major, you are basically taking general education classes, which both means that you can change your mind from week to week as to what you think you might want to transfer to. [UMKC stakeholder]

> Students making up their mind early enough where they want to go to [a four-year] school is a barrier. I tell them they better figure it out by [the undergraduate class] statics, and I still have students who say, "I don't know." Then they take classes that they don't need and decide to go to a school that accepts this class but doesn't accept that class. [MCC stakeholder]

Inconsistent Advising highlights the reality that for MCC students, academic advising is not required to enroll in courses. Additionally, MCC advisors (like many community college academic advisors) carry very large advising loads. Thus, at least in engineering, students rely on receiving academic advising from their faculty. This faculty advising load is not recognized. As study participants described:

> While we do have engineering advisors at MCC, the MCC faculty often get involved. My general role as an engineering teacher is a stop-gap. When a student can't get the answers they need from an advisor because they're stretched pretty thin, then they come talk to me or one of my engineering teacher colleagues. [MCC stakeholder]

> At community colleges, there is no expectation of service. Unless the faculty are being completely altruistic [when they advise students], they are donating massive amounts of time. What have we learned on the transfer is there is no motivation for them to spend

> one minute of time helping the students transfer if they did not just want to … when we are trying to increase transfer numbers, we are actually putting a whole bunch of extra work on folks that's not part of their job, it's not valued [by their employer]. [UMKC stakeholder]

Transfer Obstacles

Early Transfer referred to the reality that institutional policies and practices encourage MCC engineering students to transfer to UMKC before it is in their best interest to do so. As study participants described:

> MCC funnels sophomores to one of their four campuses to have good enrollment numbers. This results in some students transferring to UMKC after their freshman year and not being prepared for UMKC. [MCC stakeholder]

> It is much easier for students to get their full two years at MCC before UMKC if they are in mechanical or civil. If they choose electrical engineering or computer engineering, they usually end up transferring one or two semesters earlier just because of some of the general education requirements. Students just basically, for their own good, need to transfer earlier or else they end up taking 14 extra credit hours at MCC. [MCC stakeholder]

UMKC Gen Ed referred to the reality that UMKC abruptly changed its general education requirements within the last few years. This has had unintended negative consequences for MCC engineering transfer faculty and their students. As study participants described:

> The problem I have seen with UMKC … is the rapidity with which UMKC makes changes. They do not give us [MCC faculty] much time to react when there is a new curriculum. Sometimes it's happening beyond the scope of the engineering department, like 'Oh, UMKC has decided they're going to do Gen Ed differently' That was a relatively recent change that messed up not just engineering transfer from MCC, but other majors, and that lack of consideration for transfer students. It takes us [at MCC] a year to make a curriculum change and get it all approved and find a teacher and redo the schedule. Anything less than a year is almost impossible if you are making major rewrites of the curriculum. We need that time at wanting to react. [MCC stakeholder]

> In Missouri, if you complete your associate of arts, then you fulfill the general education requirements regardless of what the general education requirements are at the receiving institution. At UMKC, we have a strange set of general education requirements that are not typical with other institutions. If you want your general education classes to count, you want to finish the associate of arts [not your associate of science] and transfer the whole thing in. [UMKC stakeholder]

UMKC Very Prescriptive referred to the reality that earning a bachelor's degree in civil or engineering from UMKC requires adherence to very specific requirements. As study participants described:

> UMKC [civil and mechanical engineering programs] is very prescriptive. I think the very nature of trying to transfer into something that is very prescriptive can be a barrier. [UMKC stakeholder]

> One of the barriers is [MCC] students do not get on the right track necessarily, particularly for engineering. [UMKC] engineering has got very specific requirements. [UMKC stakeholder]

UMKC Obstacles referred to the reality that UMKC has implicit expectations for transfer students once they reach the UMKC campus. As study participants described:

> When they [transfer, MCC students] suddenly get this intrusive advising; especially with UMKC involved. UMKC wants to hurry them along and give them a resident student's schedule {full-time student schedule}, essentially. I think some MCC students are not quite ready for that. They never had to deal with such a schedule, and then they still have their complicated lives, so it is a little harder for them to switch it up. [MCC Stakeholder]

> There is still a culture shift that probably needs to happen at UMKC in engineering as far as being more student-centered, for lack of a better term. Just being flexible in terms of just requirements and demands of courses. We have a lot of old-school professors that want to be very strict about deadlines and in other ways that probably are not conducive to students who are struggling with their time, struggling with outside obligations. It is a culture shock [to MCC students] because I think that they do get some of that leeway at MCC, but when they arrive at UMKC, they don't always get that leeway … based on what I know has been happening on our campus, there was a culture shift during the pandemic where faculty were feeling pressured to be more flexible for students … Now that things are normalizing, the professors are asking questions along the lines of 'How much longer do we have to stay flexible?' I suspect that that flexibility, that V-wave is starting to go away. [UMKC stakeholder]

> I think one of the interesting things at UMKC that is hard to get your head around is that close to fifty percent of the students that graduate each year in civil and mechanical engineering were transfer students. Close to half of the students that graduate at UMKC are transfer students, and yet as an institution, it behaves like it caters to first-time full-time students. [UMKC stakeholder]

Discussion

As Black and Gregersen (2002) noted, seeing a need for change is not enough, stakeholders must be ready to *move* toward implementing change. Our S-STEM project has recently joined an NSF-funded S-STEM Hub initiative**,** Practices and Research on Student Pathways in Education from Community College and Transfer Students in STEM (PROSPECT S-STEM). As part of PROSECT, MCC and UMKC will develop a professional learning community (PLC). PLCs are generally defined as a group of faculty and staff who regularly collaborate in discussions, seminars, and activities to pursue shared goals (Hillard, 2012). This PLC's shared goal will be to use the findings from this study to actively work toward addressing the obstacles within the MCC-UMKC engineering transfer pathway.

The work reported in this paper was supported by two grants from the National Science Foundation, DUE-1930402 and DUE-2138074. The views in this paper are those of the authors and do not necessarily represent the views of the supporting funding agency.

References

Black, J. S., & Gregersen, H. B. (2002). *Leading strategic change: Breaking through the brain barrier.* Pearson Publishing, Upper Saddle River, NJ.

Eddy, P. L. (2010). Partnerships and collaborations in higher education. *School of Education Book Chapters 38.* Available at: https://scholarworks.wm.edu/educationbookchapters/38

Eddy, P. L., & Amey, M. J. (2014). *Creating strategic partnerships: A guide for educational institutions and their partners.* Stylus Publishing.

Eddy, P. L., & Schneider, T. L. (2019). Innovative partners for teacher education. In M. D'Amico & C. W. Lewis, Eds, *Community College Teacher Preparation for Diverse Geographies* (pp. 69-94). Information Age Publishing.

Hillard, A. T. (2012). Practices and value of a professional learning community in higher education. C*ontemporary Issues in Education Research (CIER), 5*(2), 71–74. https://doi.org/10.19030/cier.v5i2.6922

Hsieh, H., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research, 15*(9), 1277-1288.

Maher, M., Cairns, D., Kevern, J., Marszalek, J., O'Shea, K., & Justice, D. (2022). *Understanding undergraduate engineering students' pandemic experiences*. Poster presented at the ASEE 2022 Annual Conference. file:///C:/Users/Michelle%20Maher/Downloads/understanding-undergraduate-engineering-students-pandemic-experiences.pdf

Marcus, J. (2022). *How higher education lost its shine*. Available at https://hechingerreport.org/how-higher-education-lost-its-shine/

Mitchell, J.G., & Kogure, K. (2006). Bacterial motility: Links to the environment and a driving force for microbial physics. *FEMS Microbiology Ecology, 55(3),* 3-16. http://dx.doi.org/10.1111/j.1574-6941.2005.00003.x

UMKC Office of Institutional Research (n.d.). *Facts and figures*. https://data.umkc.edu/

Appendix A: KCURE Self-Study Interview Protocol

1. How long have you been part of the KCURE S-STEM Grant?
2. How would you describe your role and activities related to KCURE?
3. In what ways are you involved through KCURE in students transferring from MCC to UMKC?
4. Are there ways in which you would like to be more involved in the KCURE Program?
5. How, if at all, has your involvement with KCURE helped you understand the MCC-to-UMKC transfer process?
6. Regardless of whether they are part of KCURE, what would you say are some obstacles for engineering students who are trying to transfer from MCC to UMKC?
7. How have these obstacles changed over time?
8. What elements of KCURE you think have been most helpful?
9. Heading into the final years of this project, what could happen now to make KCURE more successful?